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A NEW SPECIES OF *CERACLEA* (TRICHOPTERA: LEPTOCERIDAE) FROM THE OZARK MOUNTAINS OF MISSOURI, U.S.A.

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Abstract.—A new species of the *Ceraclea* (*Athripsodina*) *annulicornis* species group is described from the Ozark Mountains of Missouri. ***Ceraclea* (*Athripsodina*) *maccalmonti*** n. sp. represents the ninth member of this group from the world and fourth species known from the Nearctic region. The adult genitalia, larva, and pupa are described and figured from field-collected and reared material. The known distribution of this species may be restricted to Bennett Spring in central Missouri.

Key Words: Trichoptera, *Ceraclea* (*Athripsodina*) *annulicornis* species group, Ozark Mountains, new species

The genus *Ceraclea* is one of the largest and most important groups of caddisflies in North America and the world (Morse 1975). The larvae are found in a variety of aquatic habitats, and have diverse food habits and water quality tolerances (Resh 1976). Eight species are known from the Annulicornis species group (Morse 1975, Yang and Morse 1988); five of which are Palearctic, two Holarctic and one Nearctic. In conjunction with a broader study of the caddisfly fauna of the Interior Highlands, we have discovered a ninth species belonging to this group that appears to be endemic to Bennett Spring in central Missouri. Larvae collected in June 1991 were reared in a Frigid Units Living Stream℠ for correlation of the life stages.

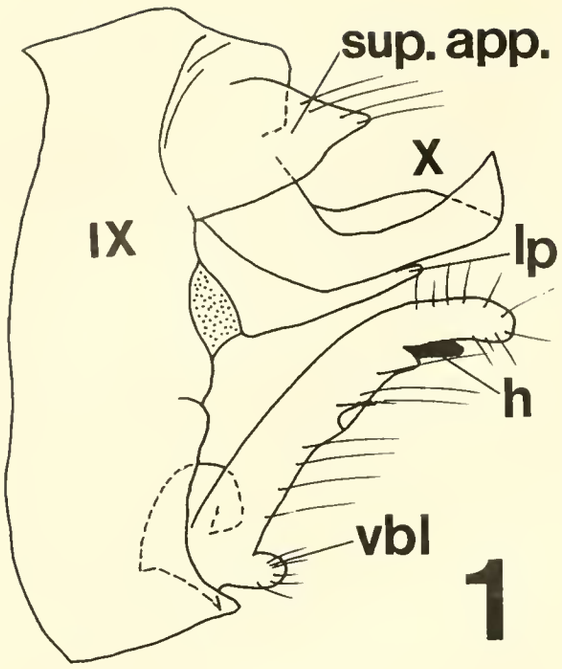
Morphological terminology and drawings follow the works of Morse (1975) for male genitalia, Nielsen (1980) for female genitalia, and Resh (1976) for larvae and pupae. Deposition of the type material is noted by the abbreviations INHS (Illinois Natural History Survey), NMNH (National Museum of Natural History), or UNT (University of North Texas).

Ceraclea (*Athripsodina*) *maccalmonti* Moulton and Stewart, New Species

Figs. 1–12

Adult.—Length 13 mm. Head yellow with brown setal warts; thoracic sclerites dark brown (in alcohol). Approximately 88 segments in each antennal flagellum; segments dark except for basal segments which each have basal half light colored. Legs lighter in color with tarsal segments darker apically. Wing venation typical of that for genus. Fore- and hind wings with membranes brown. No specific hair patterns are discernable in specimens contained in alcohol.

Male.—Figs. 1–4. Tergum X elongated and upturned with apical and lateral edges forming a high, sharp carina. Mesal area of tergum X forms a ridge best viewed laterally. Finger-like lateral processes of tergum X present and approximately two-thirds the length of the tergum. Superior appendages broad and tapering to rounded apices. Inferior appendages slender, each with harpago greatly reduced to form tooth-like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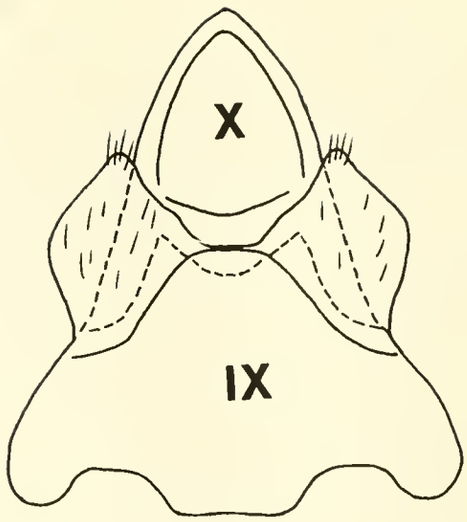
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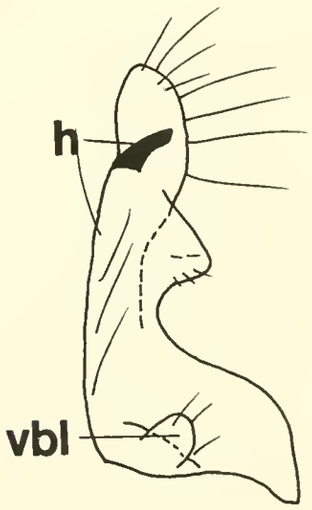
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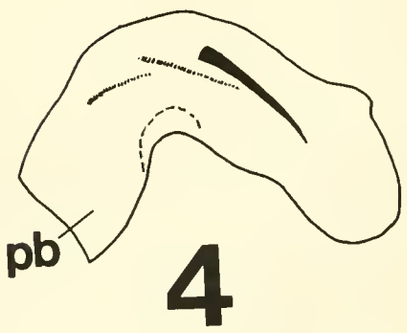
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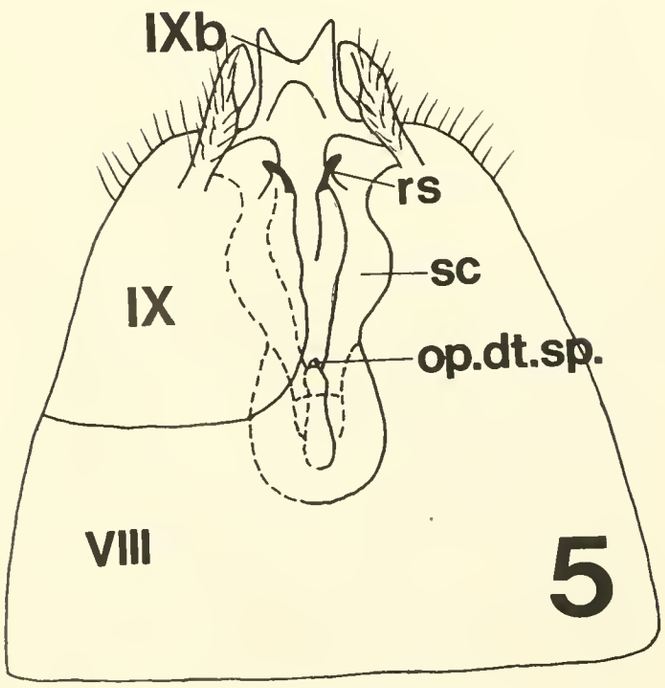
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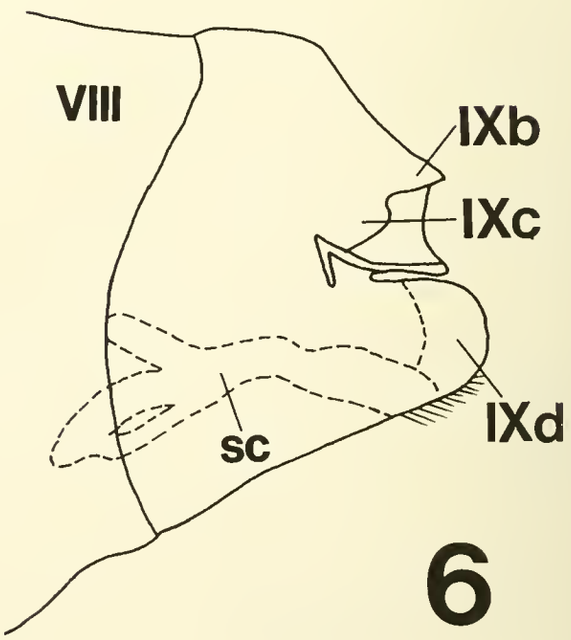
VIII
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6

structure directed mesad; ventro-basal lobe of clasper directed caudad and short, its length shorter than the basal width of appendage; phallic guide not protracted. Phallobase directed ventrad and not swollen. Phallus with two or three paramere spines; dorsal spine very prominent, others are more seta-like.

Female.—Figs. 5 and 6. General morphology similar to that of *C. annulicornis*. Rounded sclerites (rs) heavily sclerotized giving appearance of two out-curved hooks when viewed ventrally. Dorsal sclerotic bulge (IXb) long, bifurcate.

Larva.—Figs. 7–9. Length 6–7 mm. Head straw yellow with few light brown patches mostly confined to posterior half. White patches in same area along parafrontal sutures. Parafrontal areas approximately half width of the frontoclypeus. Gular sclerite roughly trapezoidal with anterior and posterior margins emarginate. Mandibles elongate, triangular with single apical tooth and two smaller mesal teeth. Pronotum straw-colored with postero-lateral and postero-mesal areas heavily sclerotized. Few light brown patches present on lateral areas. Anterior margin of pronotum crenulate with 26 setae. Mesonotum largely membranous with well defined, straw-colored mesonotal shields. Mesonotal bars evenly angled.

Pupa.—Figs. 11 and 12. Length 7–8 mm. Morphology typical for that of genus (Resh 1976). Paired presegmental plates on III and IV each with three denticles; V and VII each with four denticles; VI each with four or five denticles. Paired postsegmental plates on V each with 20 denticles. Anal rods each uniformly wide in basal half, tapering abruptly to hooked distal point. Mesal shoulder of each anal rod with well developed medial process.

Case.—Fig. 10. Length to 6–7 mm. Cornucopia-shaped, constructed of large mineral fragments and sand grains. Posterior end strongly curved in lateral view and may be broken off in larger cases.

Etymology.—This species is named in honor of Mr. Robert McCalmont, fly fisherman and aquatic entomology hobbyist, who collected some of the paratypes and generously collected and lent study material for a much larger taxonomic/biogeographic study of the caddisflies in the Interior Highland region.

Holotype, male.—Missouri, Dallas Co., Bennett Spring at source, Bennett Spring State Park (T34N, R18W, Sec. 1), 7 June 1991, S. R. Moulton (NMNH).

Paratypes.—1 male, reared, same data as Holotype (NMNH); 1 male, 2 females, same data as Holotype but 7 July 1988, B. McCalmont (INHS); 1 female, same data as holotype but Laclede Co., Bennett Spring at hatchery (Highbanks Hole) (NMNH); 1 male, 1 female, reared, same data as previous (UNT); 2 males, 5 females, same data as Holotype but 22 July 1990, B. McCalmont (INHS); 9 larvae, same data as previous (UNT).

Discussion: In terms of phylogeny, the short left (anterior) paramere spine(s) and the apico-dorsal ridge of tergum X of the male of *Ceraclea maccalmonti* indicates that it is a member of the monophyletic *C. annulicornis* Group (Morse 1975, Yang and Morse 1988). Most members of the Group (other than *C. annulicornis* (Stephens), *maccalmonti*, and *ruthae* (Flint)) also have a phallic guide of each male inferior ap-

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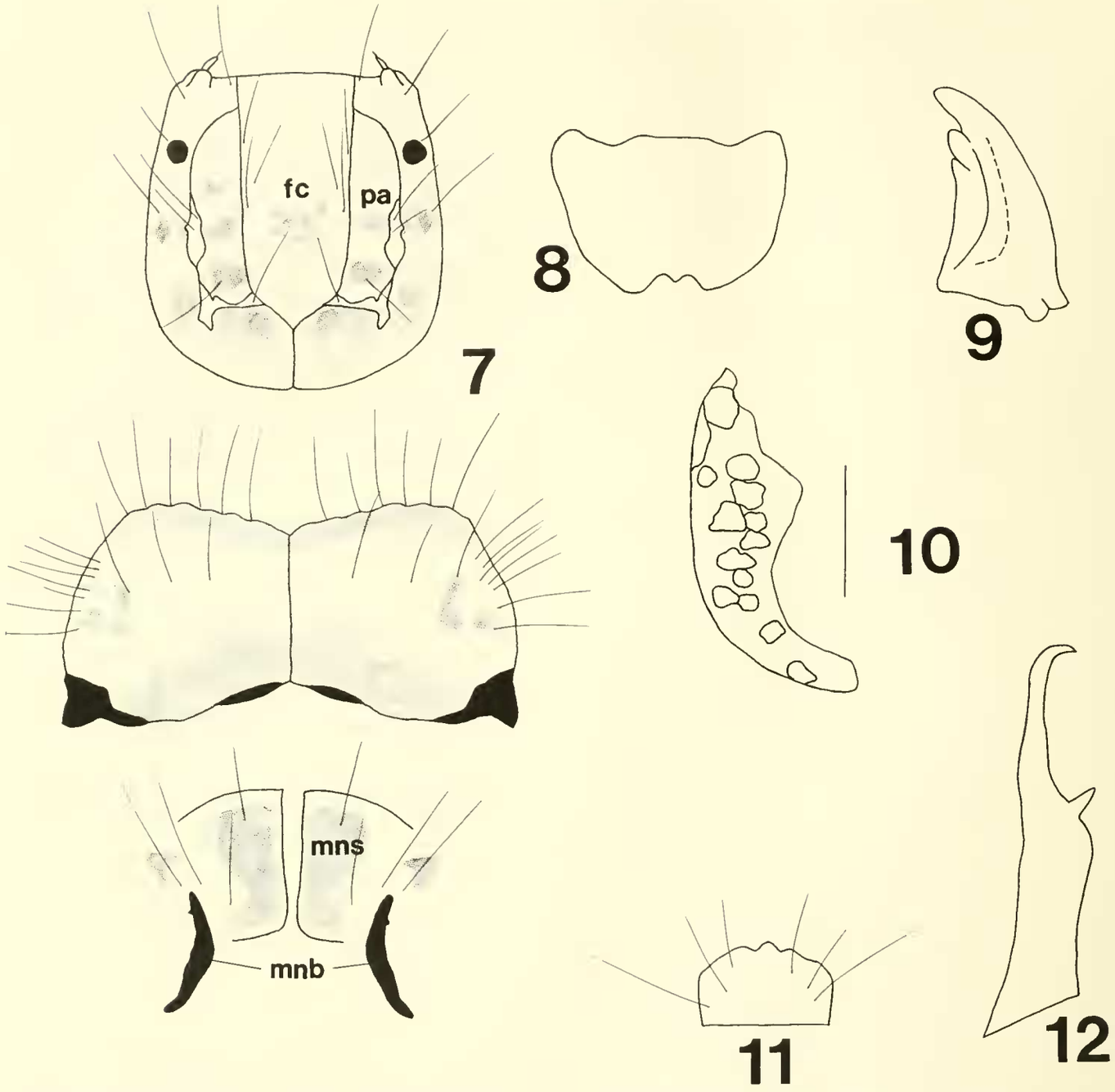
Figs. 1–6. *Ceraclea maccalmonti* genitalia. 1–4, male genitalia: 1, left lateral view; 2, dorsal view; 3, left inferior appendage, caudal view; 4, phallus, left lateral view. 5–6, female genitalia: 5, ventral view; 6, left lateral view. h = harpago, IX = abdominal segment IX, IXb = dorsal sclerotic bulge, IXc = lateral sclerotic bulge, IXd = vertical lamellae, lp = lateral process, op.dt.sp. = opening of the ductus spermathecae, pb = phallobase, rs = rounded sclerite, sc = spermathecal sclerite and associated structures, sup.app. = superior appendage, vbl = ventro-basal lobe of inferior appendage, X = tergum X.



Figs. 7–12. *Ceraclea maccalmonti* larva, larval case, and pupa. 7–9, larva: 7, head, pronotum and mesonotum, dorsal view; 8, gular sclerite, ventral view; 9, right mandible, dorsal view. 10, larval case, right lateral view, scale bar = 2 mm. 11-12, pupa: 11, labrum, dorsal view; 12, right anal rod, dorsal view. fc = frontoclypeus, mnb = mesonotal bar, mns = mesonotal sclerite, pa = parafrontal area.

pendage strongly projected dorsad, parallel with the body of the appendage. Among the nine species of the Group, *C. annulicornis, excisa* (Morton), *globosa* Yang and Morse, *maccalmonti, ruthae,* and *shuotsuensis* (Tsuda) have the short left paramere spine(s) seta-like. All of these species except *C. excisa* and *maccalmonti* also have the anterior basal end of the male phallobase enlarged and subspherical. We infer that *C. annulicornis, excisa,* and *maccalmonti* constitute a monophyletic group because of the synapomorphically smaller ventro-basal lobe of each inferior appendage, shortest in *maccalmonti* where it is shorter than the basal width of the appendage.

In terms of diagnosis, *C. maccalmonti* can be distinguished from other species of *Ceraclea* by the following combination of male characters: (1) an apico-dorsal carina border

on tergum X, closed apically (present, but open apically in *hastata* (Botosaneanu); (2) lack of a projecting phallic guide on each inferior appendage; (3) a very short ventrobasal lobe on each inferior appendage, shorter than the basal width of the appendage; (4) a normally developed anterior end of its phallobase (not subspherical); (5) setalike left (anterior) paramere spine(s); and (6) right (posterior) paramere spine not so large as in *C. annulicornis* and without a basal sclerotized plate.

The larva of *C. maccalmonti* is closest to that of *annulicornis*. It can be distinguished from the latter on the basis of the lighter head capsule (dark in *annulicornis*). The larval case of *C. maccalmonti* is easily distinguished from that of other *Ceraclea* species by having the posterior end strongly curved. The size of mineral fragments in the case of *C. maccalmonti* are much larger than those described for *annulicornis* but similar to those of *excisa* (Resh 1976).

Ceraclea maccalmonti represents the ninth species in the *C. annulicornis* Group (Morse 1975, Yang and Morse 1988) known from the world. Other members of this group include *C. annulicornis* (Holarctic), *aurea* (Pictet) (central Europe), *excisa* (Palearctic and northwestern North America), *globosa* (northeastern China), *hastata* (Korea), *ruthae* (eastern Nearctic), *shuotsuensis* (eastern Palearctic), and *sibirica* (Ulmer) (Amur region and Korea) (Morse 1975, Yang and Morse 1988). *Ceraclea maccalmonti* is now the only member of this species group known from the Interior Highland region of the Eastern United States. It appears to be endemic to the spring reach contained within Bennett Spring State Park in central Missouri. Numerous recent collections by the senior author, Bowles and Mathis (1989), Mathis and Bowles (1992) and H. W. Robison (Southern Arkansas University) have failed to locate it elsewhere in the Interior Highland region. *Ceraclea maccalmonti* was probably derived from a relict population of *C. annulicornis* or *excisa* isolated by glacial retreat.

The larva is abundant on the large cobbles found along riffle margins. Emergence occurs in June and July. Water temperatures remain constant year round at about 13°C. Bennett Spring is one of the largest springs found in the Interior Highland region with discharge averaging 100 million gallons per day.

Acknowledgments

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